

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, 2017/2018

### BOP2024 – PRINCIPLES OF OPERATION RESEARCH

(All Sections/Groups)

26 October 2017  
09.00am – 11.00am  
(2 Hours)

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#### INSTRUCTIONS TO STUDENTS

1. This question paper consists of **FIVE (5)** pages including cover page with **FOUR (4)** Questions only.
2. Attempt **ALL** the questions.
3. Please write all your answers in the Answer Booklet and Graph Papers provided.
4. The distribution of the marks for each question is given. Total marks 100.

**QUESTION 1 (25 marks)**

- a) Happy Baby Pte Ltd produces organic soya milk to supply to all the baby shops in Malaysia. The projected demand and production for organic soya milk is given as below.

	Demand (Kilogram)	Production Cost (Per Kilogram)	Production Capacity (Kilogram)
Quarter 1	20,000	0.3	40,000
Quarter 2	28,000	0.4	30,000
Quarter 3	23,000	0.6	25,000
Quarter 4	40,000	0.8	20,000

An inventory holding cost of \$1 is levied on every kilogram of organic soya milk brought over from one quarter to the next quarter.

- Define the decision variables. (3 marks)
  - Develop the objective function to minimize total cost. (3 marks)
  - Develop production capacity constraints. (4 marks)
  - Develop the constraints for balance inventory, production and demand for each quarter (Note: No beginning inventory in Quarter 1) (4 marks)
- b) Appo Electronics Cooperation produces two models of smartphone. The necessities to produce each smartphone is given below.

	R11 Plus	R9s Plus	Available
Plastic	5	4	40
Copper	5	3	36
Liquid Crystal	2	3	30

The profit for either model is \$300 per unit.

- Write the linear programming model for the above problem. (3 marks)
- Use graphical solution to find the optimal solution. (6 marks)
- Is there any excess capacity in any resource given? How much is the total cost? (2 marks)

**Continued...**

**QUESTION 2 (25 marks)**

- a) Pos Malaysia is drawing up new zones for the customers' drop boxes location in Klang Valley. Basically, Klang Valley has been divided into fourteen zones as below. Pos Malaysia has targeted eight possible locations to put the drop boxes. The following table shows the list of the drop boxes that could be reached easily from each zone.

**Table B**

<u>Zone</u>	<u>Can be Served by Locations</u>
Petaling Jaya	1, 2, 3, 7
Subang Jaya	2, 4, 5, 6, 7, 8
Shah Alam	1, 3, 4, 5
Klang	6, 7, 8
Selayang	1, 3, 5, 7, 8
Ampang Jaya	1, 3, 5, 6, 8
Kajang	3, 5, 6,
Kuala Langat	4, 5, 7, 8
Sungai Buloh	2, 4, 5
Kuala Lumpur	2, 5, 6, 7, 8
Putrajaya	1, 2, 3, 4, 7
Cheras	3, 4, 8
Puchong	1, 2, 7
Sepang	1, 2, 4, 5

Let  $X_i = 1$  if drop box location  $i$  is used, 0 otherwise.

Develop a model to provide the smallest number of locations and each zone is covered by at least **THREE (3)** boxes. (15 marks)

- b) Abby is interested in purchasing a new BMW sport bikes. He has three models to choose: K1600, F800 and S1000. After consideration, Abby has determined his decision-making criteria, assigned a weight to each criterion, and rated how well each decision alternative satisfies each criterion. The following table shows the details.

Criterion	Weight	<u>Decision Alternative</u>		
		K1600	F800	S1000
Safety protection	5	3	6	8
Fuel tank capacity	3	5	7	6
Storage capacity	2	5	6	8
Seat height	3	8	5	6
Acceleration	4	8	5	3
Vehicle weight	3	8	6	3
Driver comfort	3	4	5	8

Use a scoring model to determine the best sport bike model for Abby. (10 marks)

**Continued...**

**QUESTION 3 (25 marks)**

- a) Yoyo Enterprise is producing two products (X1 and X2) and facing three resource constraints. The following tables showed the computer output. Refer to the output and answer the following questions. Assume that Yoyo maximize profit in each case.

**Linear Programming Results**

	X1	X2		RHS	Dual
Maximize	50.	20.			
Constraint 1	1.	2.	$\leq$	45.	0.
Constraint 2	3.	3.	$\leq$	87.	0.
Constraint 3	2.	1.	$\leq$	50.	25.
Solution ->	25.	0.		1,250.	

**Ranging**

Variable	Value	Reduced Cost	Original Val	Lower Bound	Upper Bound
X1	25.	0.	50.	40.	Infinity
X2	0.	5.	20.	-Infinity	25.
Constraint	Dual Value	Slack/ Surplus	Original Val	Lower Bound	Upper Bound
Constraint 1	0.	20.	45.	25.	Infinity
Constraint 2	0.	12.	87.	75.	Infinity
Constraint 3	25.	0.	50.	0.	58.

- i) How many units of X1 and X2 should be produced? (4 marks)
- ii) How much of each of the three resources is being used? (3 marks)
- iii) Determine are the dual prices for each resource? (3 marks)
- iv) If you could take more than one of the resources, which one should you take?  
How much are you willing to pay for this? (4 marks)

**Continued...**

- b) Green tea is to be transported from three plantation regions to two canneries. Intermediate stops at a consolidation station are possible.

Plantation	Supply	Station	Cannery	Capacity
High Hill	1200	Southside	Green Bay	2500
Sunny Hill	1500	Northside	Street Bay	3000
Peace Farm	2000			

The following table showed the shipment costs of the above transportation problem. Where no cost is given, shipments are not possible. Where costs are shown, shipments are possible in either direction. Draw the network model.

	HH	SH	PF	S	N	GB	SB
High Hill (HH)		1		5		3	
Sunny Hill (SH)				4	5		
Peace Farm (PF)				6	3		
Southside (S)					2	2	4
Northside (N)						5	9
Green Bay (GB)							2
Street Bay (SB)							

(11 marks)

#### **QUESTION 4 (25 marks)**

- a) Sweet Baby Fabric is a producer of baby clothes. Recently, the company produces two models of baby clothes for eczema baby, BB88 and BB99. All the materials used in the production are produced by the company except silk, cotton and wool. These three materials need to buy from the suppliers. The BB88 model uses a yard of silk; a yard of cotton and a yard of wool, whereas the BB99 uses two yards of silk; a yard of cotton and two yard of wool. The profits for both models are \$80 each.

The company has a goal to make at least \$10,000 profit weekly. The suppliers can provide Sweet Baby Fabric with 1200-yard silk, 600-yard cotton and 800-yard wool on a weekly basis. It takes 1 hour to produce a BB88 and 1.5 hours to produce a BB99. The company needs to meet a contract of 350 units of BB99 and produce at least 500 units of baby clothes for eczema baby weekly. A total of 480 hours of labor are available weekly. Demonstrate the goal programming model.

(13 marks)

- b) State and discuss with example any **THREE (3)** types of Queuing System Models.  
(12 marks)

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